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Psychological Factors Influencing Universal Design for Learning: A Systematic Review on Inclusive Education

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Abstract
This systematic review explores the integration of Universal Design for Learning (UDL) and Self-Determination Theory - Basic Psychological Needs Satisfaction (SDT-BPNS) in early childhood education. By analyzing 14 peer-reviewed articles from 2014 to 2024, this study identifies how UDL practices address relatedness, competence, and autonomy to enhance inclusive education. Findings reveal that collaborative learning environments and positive teacher-student relationships promote relatedness, especially when culturally adapted. Competence is enhanced through scaffolded learning, differentiated instruction, and teacher training programs, though limited resources and inadequate training remain challenges. Autonomy is supported by flexible, creative, and student-centered activities, but institutional constraints often limit its effectiveness. Integrating UDL with SDT-BPNS provides a comprehensive framework addressing both structural and psychological aspects of learning. This approach enhances motivation, engagement, and inclusivity by promoting emotional and cognitive well-being. However, cultural responsiveness, institutional support, and tailored training programs are essential for effective implementation. This review highlights the need for future research to explore long-term effects and develop culturally responsive UDL frameworks that incorporate SDT-BPNS principles.

Keywords: *Universal Design for Learning (UDL), Self-Determination Theory (SDT-BPNS), Inclusive early childhood education*

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Introduction

Education goes beyond just imparting information; it is meant to foster a lifelong love of learning. It allows people flexibility to reach their greatest potential and make significant changes to the world (Dewey, 2024). An individual's success in life is greatly influenced by their education, which also affects their possibilities and general quality of life. It provides political stability, social cohesion, and economic prosperity, making it the cornerstone of society. We start our educational journey early in life by learning the fundamentals. We continue to advance our education as we become older. Nonetheless, universal access to education is necessary for it to fully realize its revolutionary potential (Idris et al., 2012).

An educational framework that embraces and encourages learning for all students, regardless of their identities, skills, or needs. Assuring that instruction and the curriculum, school facilities, classrooms, play areas, transportation, and restrooms are suitable for all children at all levels is part of this (Al-Azawei, 2016). Inclusive education ensures that every

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student fully engages in the learning process, irrespective of their background or abilities. It promotes diversity, equity, and a sense of community, which are crucial in today's globally connected world. Regarding children with special educational needs or disabilities, inclusive education has become a primary policy priority. It is designed to eliminate barriers, enhance learning outcomes, and reduce discrimination (Lindsay, 2003).

Children without impairment contact those who have disabilities more frequently in inclusive educational environments. As a result, they develop empathy and an understanding of diversity. Early infancy is seen to be the best developmental stage for developing accurate understanding of and positive beliefs towards disability, in part because it is a time when children have not yet formed strong prejudices about other people (Tiwari et al., 2015; You et al., 2019).

Previous research on inclusive education has primarily focused on its benefits for both students with and without disabilities, particularly in terms of academic and emotional development (You et al., 2019). Reviews by (Gauvreau et al., 2019) and (McGuire-Schwartz & Arndt, 2007) have highlighted the role of Universal Design for Learning (UDL) in fostering inclusive classrooms by promoting diverse methods of engagement, representation, and expression. Additionally, studies have investigated teacher perspectives on UDL, emphasizing the necessity of professional development to enhance inclusion (Horn et al., 2019). However, much of the existing literature focuses on structural and instructional aspects of UDL, with limited exploration of the psychological and motivational factors influencing both teachers and students in inclusive settings. This review aims to bridge this gap by integrating Self-Determination Theory (SDT) with UDL, offering a more holistic understanding of inclusive education that incorporates psychological well-being alongside pedagogical strategies.

Frameworks like Universal Design for Learning (UDL) have been instrumental in addressing structural barriers to inclusion. UDL promotes multiple means of engagement, representation, and expression, ensuring that the curriculum is flexible and responsive to diverse student needs. However, UDL alone does not explicitly address the psychological and motivational factors that influence student and teacher engagement in inclusive classrooms. This is where Self-Determination Theory (SDT) becomes relevant.

Additionally, Self-Determination Theory (SDT) complements UDL by emphasizing the fulfilment of three basic psychological needs: relatedness, competence, and autonomy. These needs, collectively known as the Basic Psychological Needs Satisfaction (BPNS) framework, are critical for fostering motivation, engagement, and well-being in educational settings. Integrating SDT with UDL ensures that inclusive classrooms not only address structural barriers but also cater to the emotional and psychological dimensions of learning. (Kennette & Andrew Wilson, n.d.).

The relation between SDT and UDL lies in their shared emphasis on fostering inclusive and adaptable learning environments. The principle of relatedness in SDT aligns with UDL's goal of creating inclusive classrooms where students feel a sense of belonging and connection with peers and teachers. For instance, UDL practices like collaborative activities and peer interactions help foster social bonds and emotional engagement (Lindsay, 2003).

Competence, another SDT principle, is enhanced through UDL's scaffolded instructional strategies that support both teachers and students in achieving their learning goals. This includes providing resources in diverse formats to cater to varying skill levels, thereby boosting confidence and mastery in learners (Hartmann, 2015). Autonomy is reinforced in UDL through flexible learning experiences that empower students to make choices about how they engage with and express their understanding. This combination of psychological and structural inclusivity ensures that both teachers and students thrive in dynamic, diverse educational settings (Adaka et al., 2022).

Despite the potential of inclusive education, its implementation in early childhood education (PAUD) faces significant challenges. Young learners present diverse learning needs

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due to developmental delays, physical disabilities, language barriers, and social-emotional difficulties (Chita-Tegmark et al., 2011). Many early childhood educators lack sufficient training and resources to effectively implement inclusive practices, and emotional and social barriers further complicate the learning experience (Horn et al., 2019).

Universal Design for Learning (UDL) and Self-Determination Theory (SDT) offer a comprehensive solution to these challenges. UDL principles, such as providing multiple means of engagement, representation, and expression, ensure that the curriculum is accessible and meaningful for all children. Encouraging self-monitoring in young learners fosters greater motivation and accountability in their educational journey. Problem-based learning, a hands-on approach, further enhances this process by offering practical opportunities to explore new concepts, leading to deeper understanding and engagement (Hovey & Ferguson, 2014).

For instance, scaffolding strategies and multisensory learning materials can help address the needs of children with diverse abilities. Meanwhile, SDT's focus on fulfilling psychological needs like relatedness, competence, and autonomy ensures that emotional and social challenges are effectively managed. By fostering an inclusive and supportive environment, these frameworks empower educators to create classrooms where all children can thrive, regardless of their unique needs or abilities (McGuire-Schwartz & Arndt, 2007).

As the foundations of learning are established in early childhood education, the Universal Design for Learning (UDL) framework plays a critical role in fostering flexibility and responsiveness to learner diversity. By offering a variety of engaging opportunities, UDL helps preschool teachers spark young children's interest and motivation. Educators can encourage active participation by allowing students to choose activity formats and integrating options during free play and center periods, creating a stimulating and supportive learning environment for even the youngest learners (Gauvreau et al., 2019).

Building on this foundational understanding, this Study aims to review the existing literature on the practice of UDL teachers at the early childhood school level. It focuses on identifying factors influencing UDL practice, evaluating its benefits, and examining how integrating Self-Determination Theory (SDT) frameworks can enhance psychological and educational outcomes in inclusive classrooms. Future studies will concentrate on how extending UDL's integration will improve learning outcomes at other educational levels, especially in early childhood education, when foundational learning takes place.

Methodology

The study employs a Systematic Literature Review (SLR) approach to collect, evaluate, and synthesize relevant studies on Universal Design for Learning (UDL) practices and their intersection with Self-Determination Theory's Basic Psychological Needs Satisfaction (SDT-BPNS) framework in early childhood education. To ensure a transparent and rigorous study selection process, the PRISMA 2020 guidelines were followed. The research was conducted between June and October 2024, utilizing electronic databases including Scopus, Science Direct, ProQuest, Sage, and Taylor & Francis. The search strategy applied the following query: *("Universal Design for Learning" OR UDL) AND ("early childhood education" OR Kindergarten OR Pre-School education OR Pre-K OR early education OR nursery education) AND ("Teacher" OR Instructors OR Educators OR Guru)*. This approach ensured the retrieval of comprehensive and relevant literature.

The article selection process was conducted in three stages: title and keyword screening, abstract screening, and full-text screening. To maintain the inclusion of high-quality and relevant studies, only peer-reviewed articles published between 2014–2024, written in English, and open access were considered. Furthermore, only studies that explicitly mentioned Universal Design for Learning in their title or keywords were included. Articles that did not meet these criteria, as well as unpublished works, book chapters, psychometric articles, reports, and non-open-access studies, were excluded. After applying these rigorous selection

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criteria, an initial pool of 4,688 articles was identified, which was later reduced to 14 articles after the screening process.

The final selection of studies underwent full-text analysis, where relevant data were manually extracted based on their alignment with UDL and the SDT-BPNS framework. The data extraction and synthesis were performed through manual content analysis, without the use of software. Thematic synthesis was conducted to categorize findings based on the SDT-BPNS components (relatedness, competence, and autonomy). The process involved reviewing abstracts and full texts to identify content relevant to these themes, followed by categorization based on explicit mentions or inferred relevance. The extracted findings were then compared and synthesized to identify common themes, gaps, and trends across the studies. This analytical approach ensured a systematic understanding of how UDL practices align with the SDT-BPNS framework in early childhood education.
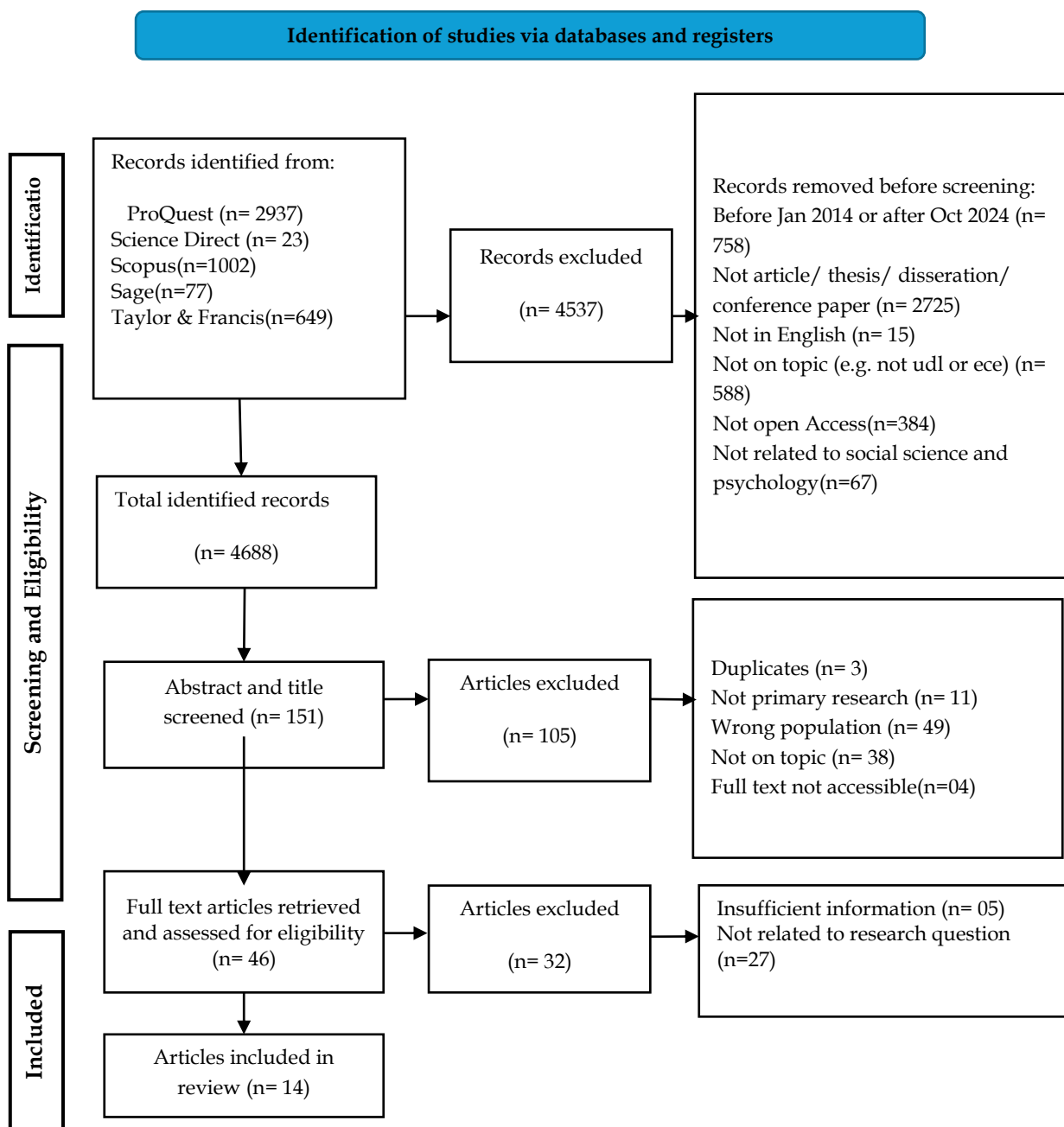
Figure 1. Prisma Diagram

Summary Of Research Study

Table 1. UDL Practices and Their Alignment with SDT-BPNS Components

no	Study	Participants	Methodology	RQ				Key findings
				RQ1			RQ2	
				Relatedness s Findings & Implications	Compet ence Findings & Implications	Autonomy y Findings & Implications	UDL Benefits	
1	Universal Design Principles for Multimodal Representation in Literacy Activities for Preschoolers Erika Fundelius, MA1, Taryn Wade, PhD1, Audrey Robbins, PhD1, Sen Wang, MA1, M. Addie McConomy, MA1, and Keisey Fumero, PhD	The participants as a varied collection of preschoolers in an inclusive classroom, including those with extensive support needs (ESN), such as children with various disabilities, visual impairments, and language delays.	To gather data for this work, multimodal and multisensory features like tactile objects, noises, and scents were included in the design and use of book boxes. These boxes were created to provide numerous forms of representation, engagement, and expression to improve literacy activities and storybook reading for preschoolers, especially those with significant	1: Inclusive peer interactions Implication: Builds classroom connections and community	1: Scaffolded activities Implication: Boosts students' skill development	1: Self-paced tasks Implication: Encourage ownership of learning	1: Increased Accessibility 2: Promotes Inclusion 3: Enhances Engagement 4: Fosters Language and Literacy Development 5: Encourages Autonomy and Self-Regulation	The utilisation of book boxes featuring tactile, auditory, and olfactory components improved storybook reading and increased accessibility for young children with a range of needs. The concepts of Universal Design for Learning (UDL) made reading programs beneficial for all children, even those with significant assistance requirements. The exercises could be customised to fit each child's unique sensory preferences by employing materials that stimulated different sensory pathways, which would improve learning results for

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			assistance requirements.					kids with impairments.
2	Utilizing the Universal Design Framework to Incorporate Nature-Based Learning Within an Early Childhood Inclusive Classroom Arianna E. Pikus , Texas A&M University, Hannah M. Etchison, Georgia State University, Hope K. Gerde, Texas A&M University, and Gary E. Bingham, Georgia State University	Preschoolers who gain from nature-based learning activities are included in the article, particularly those with exceptionalities or disabilities.	The primary data collection methods used in this study were progress monitoring, which included documenting children's interactions with nature using photographic evidence, quotations from the children, and observations from peers and teachers.	1: Collaborative learning builds trust Implication: Strengthens teacher-student relationships	1: Multimodal resources Implication: Enhances mastery for diverse learners	1Flexible engagement Implication: Empowers students to make choices	1; Inclusive Learning for All 2: Enhanced Engagement 3: Improved Academic Outcomes 4: Fosters Autonomy and Independence 5: Adaptability for Diverse Needs	In contrast to indoor environments, children—especially those with disabilities—showed improved behaviour and attention during outdoor nature-based learning. They were also more engaged. The application of Universal Design for Learning (UDL) principles has been shown to improve learning results for children with a variety of requirements, such as those with behavioural, sensory, or physical difficulties.
3.	Universal Design for Learning (UDL) Across Cultures: The Application of UDL in Kuwaiti Inclusive Classrooms	Preschoolers from inclusive classes are among the participants; special	Children's quotations, observations from peers and teachers, and photographic	1: Peer discussions foster social connections Implication: Promotes a	1: Gradual mastery approaches Implication: Improves confidence for	1: Personalized tasks Implication: Encourages decision-	1: Increased Accessibility for All Learners 2: Supports Development of Social and	By providing children with a variety of methods to interact, represent knowledge, and express learning, the use of Universal

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				RQ1			RQ2	
				Relatedness s Findings & Implications	Compet ence Findings & Implications	Autonomy y Findings & Implications	UDL Benefits	
	Almumen, Huda A.	attention is paid to kids with significant support needs or disabilities, such as developmental delays or sensory impairments.	proof were all used in the data collection process to track progress.	sense of belonging in classrooms	both teachers and students	making and autonomy	Emotional Skills 3: Personalized Learning Experiences	Design for Learning (UDL) principles enabled inclusive involvement in nature-based learning, which benefits children with various needs. When compared to standard indoor classroom settings, children including those with disabilities exhibited better attention, more engagement, and fewer behavioural difficulties when engaging in outside activities.
4.	Transforming Universal Design for Learning in Early Childhood Teacher Education from College Classroom to Early Childhood Classroom Mary Ellen MCGuire-Schwartz & Janet S. Arndt	41 teacher candidates from two distinct teacher education programs were among the study's participants. 36 teacher candidates	The study used a variety of techniques to collect data, including surveys, interviews, focus groups, observations, researcher notes and memos,	1: Collaborative Learning Environment Implication: Builds stronger peer relationships and fosters social bonding.	1: Opportunities for Mastery Implication: Supports skill development and boosts students' confidence.	1: Self-Regulated Learning Implication: Encourages decision-making and fosters independence in learning.	1 Promotes Lifelong Learning Skills 2: Personalized Learning Experiences	The implementation of Universal Design for Learning (UDL) principles resulted in increased student engagement, as observed by participants who noted increased student interest and

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		engaged in action research as part of their student teaching experience in Study One. Five teacher candidates participated in Study Two's first practicum, organising and carrying out lessons that were generally developed.	document analysis, and reflective papers.					involvement throughout lessons. The teacher candidates discovered that the action research method gave them more self-assurance and enhanced their comprehension of how to create and carry out successful, inclusive classes utilising UDL.
5.	The Differences Between Early Childhood Outcomes In The State Of Missouri And Use Of Universal Design For Learning In Early Childhood Special Education Programs Amanda M. BOYER 2016	Teachers and administrators of Early Childhood Special Education (ECSE) from 253 Missouri districts that submit Early Childhood Outcome (ECO) ratings	The researcher created a survey and used Question Pro to send it online to Early Childhood Special Education (ECSE) teachers and administrators as part of the data collection	1: Social Engagement 2: Collaboration Implication: Enhances classroom interaction and builds a sense of community.	1: Adaptation to Individual Needs Implication: Helps tailor learning to diverse skill levels, boosting mastery.	1: Student Choice 2: Self-Regulation Implication: Empowers students to make decisions and take ownership of learning.	1; Support for Diverse Learning Needs 2: Social and Emotional Development 3: Support for Diverse Learning Needs	Compared to teachers in self-contained or low-incidence classrooms, those in integrated classrooms—where students with disabilities are taught alongside peers without disabilities—reported applying UDL principles more frequently.

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		participated in this study.	approach for this study.					Depending on their position, qualification, and the number of special needs children they worked with, teachers' opinions of UDL usage differed; in general, integrated classroom teachers perceived higher levels of UDL adoption.
6.	Preschoolers With Visual Impairments and Additional Disabilities: Using Universal Design for Learning and Differentiation	Preschoolers with vision impairments and other disabilities like cerebral palsy, hearing loss, and developmental delays are among the participants in the article.	This article's data gathering strategy involves observing preschoolers participating in educational activities and working with experts, such as instructors of visually impaired children and associated service providers.	1: Collaborative Teaching and Support Implication: Builds teacher-student and peer relationships, fostering trust and teamwork.	1: Tailored Learning Opportunities Implication: Addresses diverse learning needs, boosting mastery and confidence.	1: Self-Directed Exploration Implication: Encourages independent thinking and nurtures students' problem-solving skills.	1: Increased Engagement and Motivation 2: Support for Communication Development	Children's participation in learning activities was improved when differentiated teaching and UDL concepts were integrated. Customised sensory approaches, such tactile, aural, and visual aids, improved children's access to the curriculum. Better learning results for toddlers with vision impairments and other disabilities were achieved through these approaches.

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				RQ1			RQ2	
				Relatedness s Findings & Implications	**Compet ence Findings & Implications**	**Autonomy y Findings & Implications**	**UDL Benefits**	
7.	Montessori Method and Universal Design for Learning: two methodologies in conjunction for inclusive early childhood education Nicoletta Rosati University LUMSA of Rom	The article explores how Montessori and UDL might be used to benefit all children in inclusive early childhood education, without mentioning any individuals.	The article is theoretical and does not include a specific data collection method. It focuses on comparing Montessori and UDL approaches in early childhood education.	1: Social Interaction Implication: Strengthens peer relationships and promotes a sense of belonging in classrooms.	1: Support for Individual Needs Implication: Tailors learning experiences to unique student abilities, enhancing mastery and confidence	1: Choice and Control Implication: Empowers students to make decisions about their learning, fostering independence and ownership	1: Fostering Competence and Confidence 2: Encouragement of Social Interaction	Respect for individual learning needs is emphasised by both the Montessori Method and UDL, which promote an inclusive atmosphere by recognising each child's distinct qualities and potential. By offering many avenues for involvement, representation, and expression, an integrated, inclusive curriculum that supports all children—including those with disabilities—can be developed by fusing Montessori activities with UDL concepts.
8.	Inclusive Special Education For Young Learners With Severe And Multiple Disabilities Eva Horn, Stephanie	Young children with severe and numerous impairments participated in the study.	This study's data gathering strategy used real evaluations, observations, and teamwork with educators,	1: Inclusion and Social Connection Implication: Promotes inclusivity and	1: Support for Individualized Learning Implication: Tailors educational strategies to	1: Self-Directed Learning Implication: Encourages independence and allows students to take	1: Enhanced Learning Outcomes 2: Tailored Support for Diverse Needs	The application of UDL principles ensured that students with a variety of needs may participate in learning activities by facilitating broader

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				RQ1			RQ2	
				Relatedness s Findings & Implications	**Compet ence Findings & Implications**	**Autonomy y Findings & Implications**	**UDL Benefits**	
	Parks And Zhe (Gigi) An	Furthermore, the educational process includes the involvement of teachers, therapists, and family members to guarantee the children's access to inclusive learning environments.	therapists, and families to track the children's involvement, development, and results in inclusive learning environments.	strengthens social bonds among peers and teachers	meet unique student needs, fostering skill development and confidence.	ownership of their educational journey.		access to the general curriculum. When given individualised supports in inclusive environments, children with severe and multiple disabilities showed real growth and active involvement.
9.	A Framework for Promoting Access, Increasing Participation, and Providing Support in Early Childhood Classrooms Christan G. Coogle1 · Sloan Storie2 · Naomi L. Rahn3	The essay centres on early childhood educators and how they help every kid in inclusive classrooms by UDL.	Rather than reporting on empirical data collecting, it concentrates on discussing frameworks such as Universal Design for Learning (UDL) to promote access and participation in early childhood classrooms.	1: Collaboration and Social Interaction Implication: Fosters teamwork and strengthens peer relationships in classrooms.	1: Opportunities for Succes Implication: Boosts confidence and skill mastery by providing achievable challenges.	1: Self-Directed Learning Implication: Encourages independent learning and empowers students to set and achieve their own goals.	1: Personalized Learning 2: Enhanced Engagement	All children can engage meaningfully in early childhood classes, regardless of their ability, thanks to the principles of Universal Design for Learning (UDL). UDL integration raises the standard of inclusive education by giving diverse learners adaptable and customised support.

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				RQ1			RQ2	
				Relatedness s Findings & Implications	Compet ence Findings & Implications	Autonomy y Findings & Implications	UDL Benefits	
10	Universal Design for Learning as a theory of inclusive practice for use by educational psychologists	Educational psychologists, educators, and students with diverse needs	Theoretical exploration using classroom-based examples to apply UDL principles	1. Collaborative Engagement Implication: Enhances teamwork and strengthens peer-to-peer and teacher-student relationships.	1; Equipping Educators Implication: Provides teachers with the skills and confidence needed to support diverse learners effectively.	1; Flexible Lesson Design Implication: Allows students to explore learning at their own pace, promoting independence and creativity.	Improves access to education for all learners and fosters motivation, engagement, and self-regulation	Demonstrates proactive, systemic design to ensure inclusivity, reducing the need for retrofitting and focusing on holistic educational practices
11	Cultivating Positive Classroom Environments: Exploring the Efficacy of Immersive Technologies in Removing Barriers to Learning Among Primary School Students	Six primary school teachers from two schools in Ireland, including one urban and one rural school.	Small-scale qualitative participatory research. Data was gathered through semi-structured interviews with teachers. Behavioural observations and anecdotal records were used to evaluate engagement, motivation, and self-efficacy.	1; Collaborative Peer Interactions Implication: Strengthens peer relationships in the classroom.	1; Skill Development Implication: Enhances students' capabilities and supports effective teaching strategies for mastery.	1: Choice and Personalization Implication: Encourages student independence by offering flexibility and fostering ownership of learning.	1: Personalized Learning 2: Improved Social Interaction 3; Increased Confidence	1: students demonstrated higher levels of engagement, motivation, and self-efficacy in immersive learning settings compared to traditional methods. 2: UDL-enhanced immersive technologies provided inclusive, adaptable environments that benefited both autistic students and their peers.

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				RQ1			RQ2	
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12	Inclusive Teaching of Palaeontology for People with and Without Disabilities Through Didactic Workshops	A diverse group of students, both with and without disabilities,	Multidisciplinary participatory research incorporating UDL principles. development of interactive and inclusive palaeontological workshops that use multisensory materials and flexible methods to engage all learners.	1: Collaborative Learning Implication: Fosters inclusivity and builds stronger peer and teacher-student relationships.	1: Educator Training Implication: Equips teachers with the skills and confidence to support diverse learning needs effectively.	1: Independent Learning Implication: Encourages students to take charge of their learning process, promoting empowerment and self-reliance.	1: Enhanced Accessibility 2: Inclusive Environments:	1: Inclusive palaeontological workshops significantly enhanced engagement, motivation, and participation for students with and without disabilities. 2: The study demonstrated the effectiveness of UDL in creating accessible and meaningful educational experiences.
13	Increasing Teacher Confidence in Using Universal Design for Learning to Support Students Developmental Skills Through Teacher Education at Tier 1	12 teachers from a small urban school district in the U.S., including: 5 kindergarten teachers 3 first-grade teachers 4 special education teachers working across both grades.	Pretest-post-test study over five weeks Surveys, rubrics, and focus groups to assess teachers' confidence, knowledge, and classroom practices before and after the intervention.	1 Collaborative Learning Implication: Strengthens teacher-student engagement and fosters classroom unity.	1: Knowledge Growth Implication: Enhances educators' and students' abilities to apply skills effectively in real-world scenarios.	1: Self-Directed Implementation Implication: Encourages teachers and students to independently adapt and personalize learning experiences.	1: Improved Accessibility 2: Universal Strategies 3: Fostering Inclusivity	1: Classroom strategies shifted from targeted individual supports to inclusive, universally designed interventions. 2: Teachers valued the collaborative and hands-on approach to learning UDL strategies.

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				Relatednesss Findings & Implications	Compet ence Findings & Implications	Autonomy y Findings & Implications	UDL Benefits	
14	Enhancing Early Childhood Inclusive Practices Through Universal Design for Learning: A Mixed-Methods Exploration	18 early childhood educators, 12 general education teachers 6 special education teachers.	Quantitative data from surveys and classroom assessments; qualitative data from teacher interviews and field notes.	1: Teacher-Student Connection Implication: Builds meaningful relationships, fostering trust and collaboration in the classroom.	1: Skill Development: Implication: Enhances both students' and teachers' abilities, supporting effective learning and teaching practices.	1: Empowered Decision-Making Implication: Encourages creative problem-solving and ownership of learning through innovative approaches.	1: Improved classroom accessibility 2: Development of transferable skills	1: Teachers transitioned from traditional to flexible, student-cantered instructional approaches, leading to more effective inclusion practices. 2; UDL training significantly improved teachers' confidence and ability to create inclusive classroom environments.

Results and discussion

Psychological Factors Influencing UDL Practice by Teachers in Early Childhood Education

The implementation of Universal Design for Learning (UDL) in early childhood education is significantly shaped by psychological factors related to the Self-Determination Theory - Basic Psychological Needs Satisfaction (SDT-BPNS) framework. The dimensions of relatedness, competence, and autonomy are critical in influencing how effectively UDL principles are applied and sustained in educational settings. These dimensions also affect both teachers' instructional practices and students' learning experiences.

Relatedness

The dimension of relatedness emphasizes the importance of establishing meaningful social connections and fostering emotional bonds within the learning environment. UDL practices have been shown to enhance relatedness by promoting collaborative learning, inclusive peer interactions, and positive teacher-student relationships. For instance, collaborative frameworks and immersive technologies within UDL environments effectively enhance peer interactions, emotional engagement, and cooperation among learners (Fundelius et al., 2023; Molloy & and Farrell, 2024; Ríos-Reyes et al., 2024). Inclusive learning environments that encourage students with diverse abilities to work together on shared tasks foster empathy, mutual understanding, and a sense of community.

Furthermore, UDL practices that emphasize positive teacher-student relationships contribute to a supportive and inclusive classroom atmosphere. Teachers who incorporate UDL principles report stronger emotional connections with their students, which enhances their ability to create inclusive learning environments (Chen & Dote-Kwan, 2021; McNamara & and Lee, n.d.). However, effective implementation of UDL practices also requires cultural sensitivity. For example, Almumen found that applying Western-centric UDL models in Kuwaiti classrooms without sufficient cultural adaptation led to diminished relatedness, as these models did not resonate with local values and pedagogical practices. This suggests that culturally responsive UDL practices are essential for fostering meaningful relationships, particularly in non-Western contexts(Almumen, 2020).

Overall, promoting relatedness through UDL practices involves creating inclusive environments that support emotional engagement and social bonding. However, achieving these outcomes requires culturally responsive implementation that aligns with the socio-cultural realities of the learning environment.

Competence

Competence refers to the ability of teachers and students to feel effective and confident in their instructional practices and learning experiences. Within the context of UDL, competence involves providing opportunities for skill mastery, offering constructive feedback, and fostering confidence in one's abilities. Studies consistently highlight the positive impact of UDL practices on enhancing competence, particularly through scaffolded learning opportunities and differentiated instruction.

Scaffolded learning, which involves breaking down complex tasks into manageable components, significantly improves skill mastery for students with diverse abilities (Chen & Dote-Kwan, 2021; G. Coogle et al., 2022). Additionally, Fundelius emphasize the effectiveness of multimodal literacy activities in providing varied means of engagement, representation, and expression for children requiring extensive support (Fundelius et al., 2023). The integration of Montessori principles within UDL frameworks further supports individualized learning, promoting mastery and confidence (Rosati, 2021).

Moreover, UDL practices enhance teacher competence by providing structured mentorship and professional development opportunities. Pikus and McNamara emphasize that collaborative training programs improve teachers’ efficacy in implementing UDL principles effectively. Teachers who feel confident in their instructional strategies are better

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equipped to address the diverse needs of their students and adapt their teaching practices accordingly(McNamara & and Lee, n.d.; Pikus et al., 2024).

However, effective implementation of UDL practices is contingent upon teachers' access to professional development resources. Almutairi found that inadequate training and institutional constraints significantly hinder teachers' capacity to apply UDL principles effectively, particularly in low-resource environments. Additionally, the success of differentiated instruction, a cornerstone of UDL, depends on teachers' ability to adapt their instruction to suit the diverse learning needs of their students. In contexts where teachers lack the necessary skills or resources, the effectiveness of UDL practices may be compromised(Almutairi & Alsuwayl, 2023).

Overall, enhancing competence within UDL frameworks requires continuous professional development, institutional support, and the provision of resources that enable teachers to implement inclusive practices effectively.

Autonomy

Autonomy within UDL involves fostering self-directed learning, providing learners with choices, and encouraging creativity among both teachers and students. Research consistently affirms that UDL practices can effectively promote autonomy when learners are provided with opportunities to make decisions about their learning processes.

Studies by Molloy and Ríos-Reyes demonstrate that UDL practices involving immersive technologies and creative tasks enhance student autonomy by allowing learners to interact with content according to their individual preferences (Molloy & and Farrell, 2024; Ríos-Reyes et al., 2024). Providing students with choices in how they engage with learning materials fosters motivation, self-regulation, and creativity. Furthermore, teachers who are empowered to design their own instructional approaches report higher satisfaction and professional growth (Pikus et al., 2024; Vitelli, 2015).

However, the successful promotion of autonomy within UDL frameworks is contingent upon institutional support and flexibility in instructional practices. Almutairi and McNamaranote that prescriptive curricula and standardized assessments can restrict teachers' capacity to implement UDL practices effectively. Institutional constraints that discourage creative exploration can undermine the potential of UDL to enhance autonomy, particularly when teachers are not provided with the necessary resources or support (Almutairi & Alsuwayl, 2023; McNamara & and Lee, n.d.).

Additionally, the promotion of autonomy must be culturally responsive to ensure its effectiveness across diverse contexts. UDL practices that provide autonomy without consideration of cultural norms may be less effective in environments where hierarchical or collective approaches to learning are more prevalent. Therefore, promoting autonomy within UDL frameworks requires sensitivity to cultural diversity and flexibility in instructional design.

Overall, promoting autonomy through UDL involves providing learners and teachers with opportunities for creativity, decision-making, and self-directed learning. However, achieving these outcomes requires institutional support, cultural responsiveness, and flexibility in instructional practices.

Benefits of Universal Design for Learning (UDL)

The application of Universal Design for Learning (UDL) in early childhood education offers several benefits that enhance inclusivity, engagement, and learning outcomes for diverse learners. By providing multiple means of engagement, representation, and expression, UDL promotes a more equitable and supportive learning environment that caters to individual preferences and needs. The reviewed studies highlight the positive impact of UDL practices on various aspects of teaching and learning, including accessibility, motivation, competence, autonomy, and social interaction.

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Fundelius found that the integration of multimodal literacy activities significantly improves accessibility and engagement for students with extensive support needs. By incorporating tactile, auditory, and visual aids, UDL principles enhance students' ability to interact with learning materials, thereby improving overall learning outcomes (Fundelius et al., 2023). This aligns with the findings of (G. Coogle et al., 2022), who emphasize that differentiated instruction supported by UDL frameworks allows teachers to effectively address the diverse needs of students through customized learning experiences.

Research by (Molloy & and Farrell, 2024) demonstrates the effectiveness of immersive technologies within UDL frameworks in promoting engagement, motivation, and self-regulation. Interactive and personalized learning environments provide learners with the flexibility to explore content at their own pace, fostering a deeper level of engagement and autonomy. These findings are further supported by (Ríos-Reyes et al., 2024), who report that UDL-based palaeontological workshops promote motivation and social interaction through multisensory learning activities. By removing barriers to participation, UDL practices create inclusive learning environments that accommodate a broad range of abilities and learning preferences.

Additionally, (McNamara & and Lee, n.d.) highlight that professional development and mentorship programs designed around UDL principles contribute to enhanced teacher competence and confidence. Teachers who receive structured training and collaborate with their peers are better equipped to implement inclusive practices that meet the needs of all students. This professional growth also positively impacts student learning outcomes, as teachers feel more confident in their instructional strategies and are more likely to engage in innovative pedagogical practices.

The integration of UDL principles with other instructional frameworks further enhances its effectiveness. For example, (Rosati, 2021) demonstrates how combining Montessori principles with UDL supports individualized learning experiences, promoting skill mastery and confidence. Providing learners with choices and opportunities for self-directed learning fosters autonomy, creativity, and motivation, which are essential components of effective learning.

However, while UDL offers several benefits, its successful implementation requires adequate institutional support, professional training, and cultural adaptation. (Almutairi & Alsuwayl, 2023) found that inadequate training and limited access to resources significantly hinder teachers' ability to apply UDL principles effectively, particularly in low-resource settings. The lack of professional development opportunities and standardized assessments that prioritize conformity over creativity can undermine the potential benefits of UDL, especially when teachers are not empowered to adapt their instructional practices to suit the needs of diverse learners.

Furthermore, (Almumen, 2020) emphasizes the importance of cultural responsiveness in achieving the full benefits of UDL. UDL practices that are not adapted to align with local cultural values and pedagogical norms may be less effective in promoting inclusivity and engagement. This finding underscores the need for culturally responsive approaches to UDL implementation, particularly in non-Western contexts where educational practices may differ significantly from those in Western countries.

Overall, the reviewed studies illustrate that UDL provides a comprehensive framework for enhancing teaching and learning across diverse educational settings. By promoting inclusivity, flexibility, and creativity, UDL supports the development of more responsive and equitable learning environments. However, the effectiveness of UDL practices is contingent upon adequate training, institutional support, and cultural adaptation to ensure their applicability across various contexts.

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Teachers' Self-Efficacy and Knowledge: Critical Factors in UDL Implementation

The successful implementation of Universal Design for Learning (UDL) in early childhood education is significantly influenced by teachers' self-efficacy and knowledge. These factors are essential for ensuring that UDL principles are applied effectively to promote inclusive and equitable learning environments. The reviewed studies consistently emphasize that teachers' confidence in their instructional practices and their understanding of UDL frameworks play a pivotal role in determining the effectiveness of UDL implementation.

Self-efficacy refers to teachers' beliefs in their own ability to plan, organize, and execute instructional practices that support positive student outcomes. High levels of self-efficacy are associated with greater motivation, persistence, and willingness to implement innovative teaching strategies (Sala-Bars et al., 2024). Within the context of UDL, teachers with higher self-efficacy are more likely to adopt flexible instructional approaches that cater to the diverse needs of their students (McNamara & and Lee, n.d.; Vitelli, 2015)

The findings of (McNamara & and Lee, n.d.) illustrate that teachers who undergo structured training and mentorship programs designed around UDL principles report higher levels of self-efficacy. These programs provide opportunities for collaborative learning, peer feedback, and hands-on practice, which enhance teachers' confidence in applying UDL strategies. Similarly, (Pikus et al., 2024) emphasize that when teachers are provided with the freedom to design their instructional approaches, they report greater satisfaction and professional growth, which in turn enhances their self-efficacy.

Conversely, limited access to resources and inadequate training can undermine teachers' self-efficacy. (Almutairi & Alsuwayl, 2023) report that teachers who lack formal training in UDL often struggle to implement inclusive practices effectively, particularly in low-resource environments. This finding highlights the importance of providing teachers with comprehensive training programs that not only enhance their theoretical understanding of UDL but also offer practical strategies for application in diverse educational settings.

Furthermore, the integration of UDL principles within existing instructional frameworks is shown to enhance teacher self-efficacy. For example, (Rosati, 2021) demonstrates that combining Montessori principles with UDL enhances teachers' confidence in promoting individualized learning experiences. When teachers are equipped with a repertoire of strategies that align with their instructional philosophies, they feel more empowered to address the diverse needs of their students.

Knowledge of UDL principles is equally critical for effective implementation. Teachers' understanding of how to apply UDL frameworks to instructional activities directly influences their ability to create inclusive learning environments. Previous studies have consistently highlighted the importance of providing teachers with the knowledge and skills necessary to implement UDL effectively (Alquraini & Rao, 2018; Lambert et al., 2023). This knowledge includes familiarity with the three core principles of UDL: providing multiple means of engagement, representation, and expression.

Research by (G. Coogle et al., 2022) underscores that teachers who have a strong grasp of UDL principles are better able to design flexible learning environments that accommodate a wide range of abilities and learning preferences. By incorporating various instructional methods, such as hands-on activities, multisensory resources, and differentiated assessments, teachers can enhance students' engagement and learning outcomes. Fundelius similarly emphasize that multimodal literacy activities are particularly effective for promoting accessibility and engagement among children requiring extensive support (Fundelius et al., 2023).

However, a lack of knowledge about UDL can result in ineffective implementation, particularly when teachers are expected to apply inclusive practices without adequate training. (Almutairi & Alsuwayl, 2023) report that many teachers face challenges in designing inclusive assessments and applying iterative instructional strategies. These gaps in knowledge

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can undermine the potential benefits of UDL and limit its applicability in diverse educational settings.

Furthermore, cultural responsiveness is essential for ensuring that teachers' knowledge of UDL aligns with the socio-cultural realities of their learning environments. (Almumen, 2020) highlights that applying Western-centric UDL models in non-Western contexts without proper cultural adaptation can result in diminished effectiveness. Teachers who are not equipped with culturally responsive strategies may struggle to engage students whose learning preferences are shaped by their cultural backgrounds.

Overall, the findings indicate that enhancing teachers' self-efficacy and knowledge is crucial for promoting effective UDL implementation. Professional development programs that provide structured training, collaborative learning opportunities, and practical resources are essential for equipping teachers with the skills and confidence needed to apply UDL principles successfully. Moreover, culturally responsive training is necessary to ensure that teachers' knowledge of UDL is relevant and applicable across diverse contexts.

Conclusion

The findings of this systematic review underscore the critical importance of integrating Universal Design for Learning (UDL) with the Self-Determination Theory - Basic Psychological Needs Satisfaction (SDT-BPNS) framework in early childhood education. This integration not only addresses structural barriers to inclusion but also provides a comprehensive approach that caters to the psychological and emotional dimensions of learning. The dimensions of relatedness, competence, and autonomy are shown to be essential in enhancing both teacher and student engagement, motivation, and overall learning outcomes.

UDL practices that promote relatedness through collaborative learning environments, positive teacher-student relationships, and inclusive peer interactions have demonstrated effectiveness in fostering social bonds and emotional engagement. However, these practices must be culturally responsive to be truly effective, particularly when applied in diverse contexts. Similarly, competence is enhanced through scaffolded learning opportunities, differentiated instruction, and structured mentorship for teachers, all of which contribute to skill mastery and confidence. However, the lack of adequate training and institutional support can significantly hinder teachers' capacity to implement UDL effectively. Autonomy is promoted by providing students and teachers with opportunities for creativity, decision-making, and self-directed learning. Yet, institutional constraints such as prescriptive curricula and standardized assessments can undermine these efforts.

From a practical standpoint, the findings highlight the need for professional development programs that are comprehensive, culturally responsive, and aligned with the principles of UDL. Teachers require not only theoretical knowledge of UDL but also practical strategies for implementation across diverse educational settings. Furthermore, the incorporation of SDT-BPNS within UDL frameworks provides a more holistic approach that recognizes the importance of psychological well-being alongside pedagogical strategies.

Theoretical implications of this review suggest that integrating UDL with SDT-BPNS offers a robust framework for inclusive education that can be applied across various contexts. By addressing both structural and psychological aspects of learning, this integrated approach provides a more comprehensive understanding of how to foster inclusive educational environments.

Despite these contributions, this review acknowledges certain limitations. Most studies reviewed are situated within Western contexts, which may limit the generalizability of findings to non-Western educational environments. Additionally, the lack of longitudinal studies prevents a deeper understanding of how UDL and SDT-BPNS integration impacts long-term learning outcomes. Furthermore, limited attention has been given to the

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perspectives of teachers working in low-resource settings, where the availability of resources and institutional support is often constrained.

Future research should focus on developing culturally responsive training programs for early childhood educators that incorporate both UDL principles and SDT-BPNS dimensions. Additionally, there is a need for more empirical studies examining the long-term effects of this integrated framework on student learning outcomes, particularly in non-Western contexts. Recommendations for policy development include ensuring institutional support for UDL practices, promoting flexibility in pedagogical approaches, and fostering collaboration among educators through mentorship and professional learning communities.

Ultimately, the integration of UDL with SDT-BPNS provides a promising pathway for enhancing inclusive practices in early childhood education. By addressing both structural and psychological dimensions of learning, this framework holds significant potential for creating equitable and responsive educational environments that cater to the diverse needs of all learners.

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